

CLAIMS

1. A method for encoding a block of digital information, utilizing a format which comprises a plurality of fields wherein a target codeword represents at least a portion of the block and wherein at least one field is selected from:
- 5 (a) a field including an encoded estimate of the degree of correlation between the block and a plurality of further blocks of digital information at a decoder;
- (b) a field including an encoded index of a set of a plurality of code words, wherein the set includes the target codeword and the value of the set; and
- (c) a field including an encoded hash value derived from the target codeword.
- 10
2. A method for encoding a block of digital information in a sequence of blocks of digital information, comprising a step of ascertaining a degree of correlation of the block with a plurality of predecessor blocks of the sequence.
- 15
3. The method of claim 2, wherein ascertaining the degree of correlation comprises determining residue energy with respect to at least one of the predecessor blocks.
4. The method of claim 3, wherein ascertaining the degree of correlation
- 20 further comprises counting frame pixels above a residue energy threshold.
5. The method of claim 2, wherein ascertaining the degree of correlation further comprises determining variance of pixel-to-pixel differences between the block and each of the predecessor blocks.
- 25
6. The method of claim 2, wherein ascertaining the degree of correlation comprises using transform domain values of residue energy information.
7. The method of claim 6, wherein the transform is Discrete Cosine
- 30 Transform.

8. The method of claim 7, wherein relative values of DC and AC coefficients are used.

5 9. The method of claim 3, wherein the predecessor block is a co-located block in predecessor information.

10. The method of claim 3, wherein ascertaining the degree of correlation comprises utilizing predecessor information.

10 11. The method of claim 10, wherein residue energy information is represented by encoding with a codebook available at both the encoder and a prospective decoder.

15 12. The method of claim 2, wherein ascertaining the degree of correlation comprises the steps of:

(a) using the method of claim 3 on a least a portion of information from each of a plurality of predecessor blocks; and

(b) ascertaining the degree of correlation by using at least a portion of values obtained in step (a).

20

13. The method of claim 12, wherein choosing the plurality of blocks comprises taking into account feedback from a decoder.

25 14. The method of Claim 12, wherein choosing the plurality of blocks is in a predetermined pattern.

30 15. The method of claim 14, wherein the predetermined pattern consists of overlapping predecessor blocks which are displaced from the position corresponding to the block to be coded by a set amount.

16. The method of claim 12, wherein the predecessor blocks are chosen so as to minimize correlation with respect to the current block, and minimize relative overlap of blocks.

5 17. The method of claim 16, wherein blocks first are selected by means of matching techniques, then ranked in order of correlation to form a first list, and wherein a final list is obtained by removing from the first list blocks having substantial overlap with their predecessors in the first list.

10 18. The method of claim 16, wherein motion estimation is utilized in selecting predecessor blocks.

15 19. The method of claim 12, wherein selecting predecessor blocks is for maximizing likelihood of at least one predecessor block being present at a prospective decoder.

20 20. The method of claim 12, wherein encoding takes into account information on distribution of blocks into packets for transmission over a communications link, and wherein the predecessor blocks are chosen so that the number of different packets containing predecessor blocks is maximized.

21. The method of claim 2, wherein ascertaining the degree of correlation comprises partitioning the block into sub-blocks and, for at least a portion of the sub-blocks,

25 (a) using at least one of the methods of claims 3, 6 and 12; and
 (b) using at least a portion of values obtained in step (a).

22. The method of claim 21, wherein step (a) comprises using a weighted sum.

30 23. The method of claim 2, wherein ascertaining the degree of correlation comprises

(a) using at least one of the methods of claims 3, 6, 12 and 21 on a low-resolution representation of the block; and

(b) using at least a portion of values obtained in step (a).

5 24. The method of claim 23, wherein step (a) comprises using a weighted sum.

 25. The method of claim 2, wherein ascertaining the degree of correlation further comprises

10 (a) using at least one of the methods of claims 3, 6, 12, 21 and 23 in selecting predecessor blocks, and

 (b) generating motion vector information for at least a portion of the selected blocks.

15 26. The method of claim 25, wherein step (a) comprises using a weighted sum.

 27. The method of claim 25, where the motion vector information is represented by encoding with a codebook available at the encoder and a prospective
20 decoder.

 28. A method for encoding a block of digital information, comprising the steps of:

 identifying a target codeword which represents at least a portion of the block;
25 and

 determining a plurality of codewords such that the plurality includes the target codeword.

 29. The method of claim of 28, wherein the target codeword is partitioned so
30 that

 (a) the plurality of codewords is determined for at most a portion of the target codeword; and

(b) a complementary portion of the target codeword is intra-coded as represented by encoding with a codebook available at both the encoder and a prospective decoder.

5 30. The method of claim of 29, wherein the partition is determined by encoding with a codebook available at both the encoder and the prospective decoder.

 31. The method of claim 30, wherein a value of the plurality of codewords is determined using channel codes.

10

 32. The method of claim 31, wherein the codes are linear channel codes.

 33. The method of claim 32, wherein the codes are multi-level linear channel codes, with a separate channel code for each bit-plane of the target codeword.

15

 34. The method of claim 30, wherein the partition is such that a first portion of the codeword will be transmitted according to step (a) of claim 29, and a second portion adjacent to the first portion will be transmitted according to step (b) of claim 29, with the encoder providing to the decoder adjacency information.

20

 35. The method of claim 30, wherein portions of different type are transmitted in alternating fashion.

 36. The method of claim 29, wherein only portions of the target
25 codeword that are zero are sent in intra mode.

 37. The method of claim 30, wherein location information of different portions of the target codeword is conveyed via hash information.

30 38. A method for encoding a block of digital information, comprising the steps of

(a) identifying a target codeword that represents at least a portion of the digital information; and

(b) determining a hash value from the target codeword.

5 39. The method of claim 38, wherein the hash value is determined as a checksum on the target codeword.

40. The method of claim 38, wherein the hash value is determined as intra-information from the method of claim 29.

10

41. The method of claim 38, wherein the hash value is determined by using the most significant bit-plane for a portion of the target codeword.

15 42. The method of claim 38, wherein the hash value is determined by generating an arithmetic code based on a Continuous Error Detection codeword.

43. The method of claim 38, wherein the hash value is determined by using a combination of methods of claims 39, 40, 41 and 42.

20 44. The method of claim 38, for a prospective decoder to keep a table of most likely codewords that result in each hash value.

45. The method of claim 44, wherein the encoder has access to the table, for providing the decoder with a code to indicate values encoded.

25

46. The method of claim 38, wherein the hash value is for a concatenation of a plurality of blocks.

30 47. The method of claim 46, wherein the blocks are selected so that a hash value is determined for each row of blocks within a frame and for each column of blocks within a frame.

48. The method of claim 46, wherein consecutive blocks following a predetermined scan of video frame blocks are concatenated to generate a hash value for the plurality of blocks.

5 49. A method for encoding a block of digital information, comprising at least one of the steps of:

 (a) identifying a target codeword that represents at least a portion of the block of digital information;

 (b) utilizing the method of claim 2 for determining at least one of the degree
10 of correlation of the block of digital information and the target codeword that represents the block with a plurality of blocks in the predecessor information;

 (c) utilizing the method of claim 28 for determining a set of plurality of codewords, wherein the set contains the target codeword;

 (d) utilizing the method of claim 38 for determining a hash value that is
15 derived from the target codeword; and

 (e) utilizing the method of claim 1 for representing at least some of the values obtained in steps (b), (c) and (d).

 50. The method of claim 49, wherein the block represents at least one pixel
20 value in digital video information.

 51. The method of claim 49, wherein the block represents a macro-block in a frame of digital video information.

25 52. The method of claim 49, wherein the target codeword representing at least a portion of the block is quantized.

 53. The method of claim 49, wherein the block of digital information is partitioned into sub-blocks, the method comprising the steps of:

30 (a) for each of at least a portion of sub-blocks, identifying a target codeword that represents at least a portion of the corresponding sub-block of digital information;

(b) concatenating target codewords corresponding to at least a portion of sub-blocks to form another target codeword;

(c) partitioning the target codeword into a plurality of target codewords;

(d) for each of at least a portion of the target codewords, using the method of claim 2 for determining at least one of the degree of correlation of the target codeword with the predecessor information;

(e) for each of at least a portion of the target codewords, using the method of claim 28 for determining a plurality of codewords, wherein the plurality contains the target codeword;

(f) for each of at least a portion of the target codewords, using the method of claim 38 for determining a hash value that is derived from the target codeword;

(g) for each of at least a portion of the target codewords, using the method of claim 1 for representing at least some of the values obtained in steps (d), (e) and (f).

54. A method for decoding an encoded block of digital information, comprising the steps of:

(a) using an encoded index to determine a set of candidate code words;

(b) using the index to infer a set of cues;

(c) using the index to infer the hash value associated with a target codeword;

(d) determining a subset of the set of candidate codewords by operating the set of cues on the set of candidate codewords;

(e) determining the codewords from the subset of candidate codewords to generate a hash value that is in agreement with the target codeword hash value;

(f) using the determined codewords along with the set of cues to generate a representation of the encoded block of digital information.

55. The method of claim 54, wherein, if multiple values satisfy a target hash value, a preferred candidate is identified upon comparing the target codeword intra-encoded information with corresponding information in the candidate.

56. A method for encoding a sequence of blocks of digital information, comprising the steps of:

(a) using the method of claim 49; and

5 (b) making decisions between modes that are appropriate for a given set of constraints.

57. The method of claim 56, wherein the decisions are made per block or on a plurality of blocks.

10 58. The method of claim 56, wherein the constraints include a given budget of bits.

59. The method of claim 58, wherein the constraints further include a given target quality.

15 60. The method of claim 56, wherein the modes include various coding modes for a block.

20 61. The method of claim 60, wherein one of the modes is an intra-mode.

62. The method of claim 61, wherein one of the modes is a syndrome-mode.

25 63. The method of claim 58, wherein a given budget of bits is divided between a plurality of fields that are used for at least one of ascertaining degree of correlation, encoding the index of a set containing a plurality of codewords, and encoding a hash value.

30 64. The method of claim 56, further using information that is sent back by the decoder for making appropriate decisions.

65. A method for encoding a sequence of blocks of digital information, comprising the steps of:

(a) encoding each block in a frame in intra mode to meet a set rate-distortion criterion, as specified by either a target rate or a target distortion;

(b) obtaining for each block in the frame rate and distortion values for the chosen quantization parameters;

5 (c) estimating, for each candidate, at least one alternative coding mode for the respective rate and distortion;

(d) selecting the coding mode that minimizes a suitable weighted sum of rate and distortion.

10 66. The method of claim 65, wherein the distortion of a block encoded using a syndrome mode is calculated as a weighted sum of

(i) distortion when the block is correctly decoded; and

(ii) distortion at the decoder when the block obtained from correct decoding is replaced by a selected predecessor block at the decoder.

15

67. The method of Claim 66, wherein the selected predecessor block is the block collocated with the current block in the previous frames.

20 68. A method for encoding a block of digital information, comprising the steps of:

(a) generating a plurality of different encodings for the block; and

(b) selecting from the plurality of encodings.

25 69. The method of claim 68, wherein the different encodings are generated using different formats.

70. The method of claim 69, wherein the different encodings represent the block at different resolutions.

30 71. The method of claim 70, wherein an encoding at a lesser resolution at least in part will serve a prospective decoder for decoding at a greater resolution.

72. The method of claim 68, wherein at least one of the encodings is effected using the method of claim 49.

73. The method of claim 71, wherein encoding for least resolution is effected
5 using the method of claim 49.

74. The method of claim 71, wherein encoding for the greatest resolution is effected using the method of claim 49.

10 75. The method of claim 74, wherein at least one of the encodings is effected using a format selected from a group of standard formats including MPEGx/H.26x format for digital video information.

76. A method for transmitting digital information, comprising a step of
15 converting from one format of encoded digital information to another format, usable by a prospective decoder.

77. The method of claim 76, wherein the format converted from is a standard format selected from a group of formats comprising MPEGx/H.26x for digital video
20 information.

78. The method of claim 77, wherein the format converted to is as in claim 1.

79. The method of claim 76, wherein the format converted from is as in
25 claim 1.

80. The method of claim 77, wherein the format converted from is selected from a group of standard formats including MPEGx/H.26x for digital video information.
30

81. The method of claim 76, wherein the format converted to is an authentic representation of the digital video information.

82. The method of claim 76, wherein the authentic representation is validated by information in addition to predecessor information.

5 83. A method for encoding a block of digital information, comprising the steps of:

(a) generating an encoding for the block of digital information with a specified format; and

10 (b) using the method of claim 49 for generating another encoding of the block of digital information.

84. The method of claim 83, wherein predecessor information further comprises information represented by a specified format about the block of digital information.

15

85. The method of claim 84, wherein the specified format is selected from a group of standard formats comprising MPEGx/H.26x format for digital video information.

20 86. A method for transferring digital information, comprising encoding by the method of claim 49 and using a decoder which sends information to the encoder that can be used by the encoder.

87. The method of claim 86, wherein the information sent by the decoder is
25 used by the encoder to ascertain a degree of correlation using the method of claim 2.

88. The method of claim 87, wherein the information comprises motion vector information inferred by the decoder.

30 89. The method of claim 87, wherein the information comprises an estimate of the properties of the channel between encoder and decoder.

90. The method of claim 96, wherein the information comprises decoding results of prior transmissions.

5 91. The method of claim 86, wherein the information comprises state information about the decoder.

92. The method of claim 91, wherein the state information comprises an estimate of predecessor information available at the decoder.

10 93. The method of claim 91, wherein the state information comprises processor state at the decoder.

15 94. A method for encoding digital video information, wherein the digital video information is from a plurality of sources, the method comprising generating a plurality of encodings for each source using the method of claim 49 with/without collaboration between sources.

20 95. The method of claim 94, wherein predecessor information further comprises information represented by at least a portion of encodings from other sources.

25 96. The method of claim 94, wherein encodings from a plurality of sources are used by the decoder to generate a representation of digital video information at a higher resolution than from individual sources.

97. A method for transferring digital information, comprising the steps of:
(a) encoding by the method of claim 94; and
(b) using a decoder that sends information that can be used by a plurality of encoders.
30

98. The method of claim 97, wherein the information sent by the decoder is used by a plurality of encoders using the method of claim 2 to ascertain a degree of correlation.

5 99. The method of claim 97, wherein the information comprises motion vector information inferred by the decoder.

100. The method of claim 97, wherein the information comprises an estimate of the properties of a channel between a plurality of encoders and the decoder.

10

101. The method of claim 97, wherein the information comprises decoding results of prior transmissions.

102. The method of claim 97, wherein the information comprises state
15 information about the decoder.

103. The method of claim 102, wherein the state information comprises an estimate of the predecessor information available at the decoder.

20 104. The method of claim 102, wherein the state information comprises processor state at the decoder.

105. A method for encoding digital video information, wherein the digital video information is captured by a series of elementary
25 sensors arranged on a grid, and wherein information from at least one sensor or a group of neighboring sensors is directly encoded before being transferred to a processor for further processing and compression.

106. The method of claim 105, wherein information obtained from the
30 sensors is first represented by a target codeword, with a codebook being available at both encoder and decoder, and

(a) for at most a portion of sensor data, the encoder identifies a set of a plurality of codewords such that the set contains the target codeword for one sensor, and a set index is communicated to the decoder; and

(b) for the remaining sensor data an original intra codeword is
5 communicated to the decoder.

107. A method for encoding a block of digital information for a plurality of decoders, comprising generating multiple encodings for the block of digital information.

10

108. The method of claim 107, wherein the encodings are generated using the method of claim 68.

109. The method of claim 107, wherein each encoding generates a
15 representation of the block at some resolution.

110. The method of claim 108, wherein a decoder uses at least a portion of the encodings.

20 111. The method of claim 109, wherein an encoding corresponding to a resolution is for a decoding which uses at least a portion of encodings for lesser resolutions.

25 112. The method of claim 107, wherein at least a portion of the encodings are generated using the method of claim 49.

113. The method of claim 107, wherein each encoding generates a representation of the block corresponding to a certain degree of correlation.

30 114. The method of claim 113, wherein a decoder uses at least a portion of the encodings.

115. The method of claim 114, wherein an encoding corresponding to a degree of correlation is for a decoding which uses at least a portion of encodings for lower correlations.